Maryland State Department of Education
Preparing World-Class Students

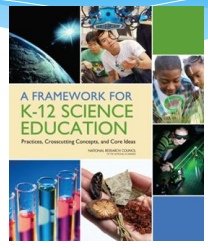
# NGSS 101

Next Generation Science Standards
Adoption & Implementation

NEXT GENERATION SCIENCE STANDARDS
For States, By States

## To what extent have you interacted with this document?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. Huh?

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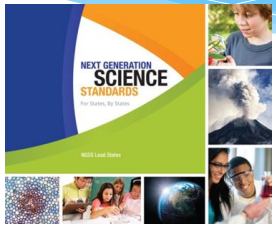
## How about this one?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. No clue




SCIENCE

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## Or this one?

A. I've read it thoroughly.
B. I've skimmed it for general information.
C. It's on my bookshelf.
D. It's the first time I've seen it.


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## Why, What, Who, When & Where

- Explain the reasons for building new science standards.
- Describe the process and timeline for constructing the Framework and the NGSS.
- Describe the structure of a standard within NGSS.
- Discuss the implications of the "shifts" in NGSS for teaching and learning.
- Examine instructional strategies that reflect the intent of NGSS.

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## Why were the NGSS developed?

Goal

*For all students to:*

- Have appreciation for the beauty and wonder of science
- Have sufficient knowledge of science and engineering to engage in public discussions
- Be careful consumers of scientific information relevant to their daily lives
- Continue to learn about science outside school
- Have the skills to enter careers of their choice, including (but not limited to) science, engineering and technology.

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## Data to Inform Action

TIMSS 2015

OECD PISA

NAEP NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

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## The National Assessment of Educational Progress (NAEP)

* **NAEP** is the largest nationally representative and continuing assessment of what America's students know and can do in various subject areas.

NAEP NATIONAL ASSESSMENT OF EDUCATIONAL PROGRESS

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## 2009 NAEP Science Results

**Grade 4**

34%

of students perform at or above Proficient

**Grade 8**

30%

of students perform at or above Proficient

**Grade 12**

21%

of students perform at or above Proficient

National Assessment of Educational Progress (NAEP), 2009 Science Assessment, p. 8

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## Program for International Student Assessment

- **PISA** is an international assessment that measures 15-year-old students' **reading, mathematics,** and **science literacy**.
- PISA also includes measures of general or **cross-curricular competencies,** such as **problem solving**.
- PISA emphasizes **functional skills** that students have acquired as they near the end of compulsory schooling.

OECD PISA

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## 2009 PISA Science Results Grade 10

29%

of students scored at or above level 4—the level at which students can complete higher order tasks.


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Highlights from PISA 2009, p. 26

## Trends in International Mathematics and Science Study

TIMSS provides reliable and timely data on the **mathematics** and **science** achievement of U.S. students compared to that of students in other countries.

IEA TIMSS 2015

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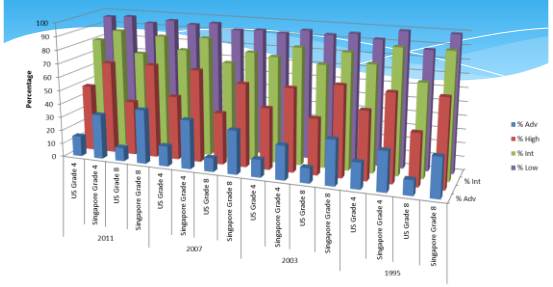
## TIMSS Performance: US v. Singapore




TIMSS 2011 Science, p. 88-89, p. 116-117

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## TIMSS Performance

United States v Singapore Benchmark Achievement

| Grade 4 | % Advanced | | % High | | % Intermediate | | % Low | |
|---|---|---|---|---|---|---|---|---|
| | US** | Singapore* | US | Singapore | US | Singapore | US | Singapore |
| 2011 | 15 | 33 | 49 | 68 | 81 | 89 | 96 | 97 |
| 2007 | 15 | 36 | 47 | 68 | 78 | 88 | 94 | 96 |
| 2003 | 13 | 25 | 45 | 61 | 78 | 86 | 94 | 95 |
| 1995 | 19 | 14 | 50 | 42 | 78 | 71 | 92 | 89 |
| **Grade 8** | **% Advanced** | | **% High** | | **% Intermediate** | | **% Low** | |
| | US*** | Singapore* | US | Singapore | US | Singapore | US | Singapore |
| 2011 | 10 | 40 | 40 | 69 | 73 | 87 | 93 | 96 |
| 2007 | 10 | 32 | 38 | 61 | 71 | 80 | 92 | 93 |
| 2003 | 11 | 33 | 41 | 66 | 75 | 85 | 93 | 95 |
| 1999 | 12 | 29 | 37 | 60 | 67 | 84 | 87 | 95 |
| 1995 | 11 | 29 | 38 | 64 | 68 | 91 | 87 | 99 |

* Rank = 1; ** Rank = 5; ***Rank = 9

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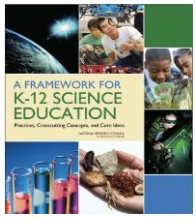
TIMSS 2011 Science, p. 88-89, p. 116-117

## Where do you start when developing new standards?

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## Building on the Past; Preparing for the Future


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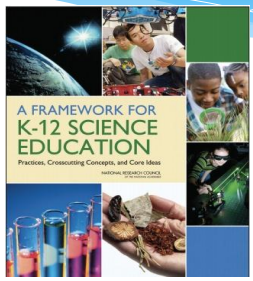
## A New Vision of Science Learning that Leads to a New Vision of Teaching

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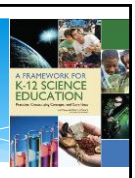
## Vision for Science Education




"The framework is designed to help realize a vision for education in the sciences and engineering in which **(all) students**, over **multiple years** of school, **actively engage** in science and engineering **practices** and apply **crosscutting concepts** to deepen their understanding of the **core ideas** in these fields."

*A Framework for K-12 Science Education pp. 8-9*

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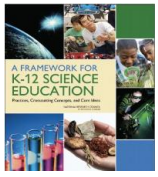
## The framework is built on the notion of learning as a developmental progression.

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It is designed to help children continually build on and revise their knowledge and abilities, starting from their curiosity about what they see around them and their initial conceptions about how the world works.

*Framework, p.11*

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## Who developed the NGSS?

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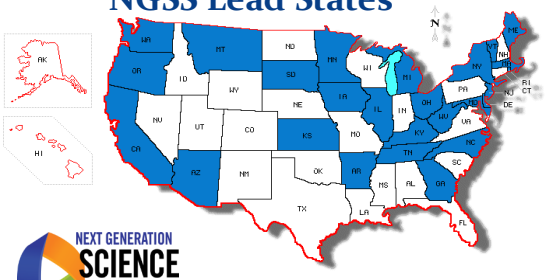
## NGSS Lead States

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http://www.nextgenscience.org/maryland

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## What does a standard look like in the NGSS?

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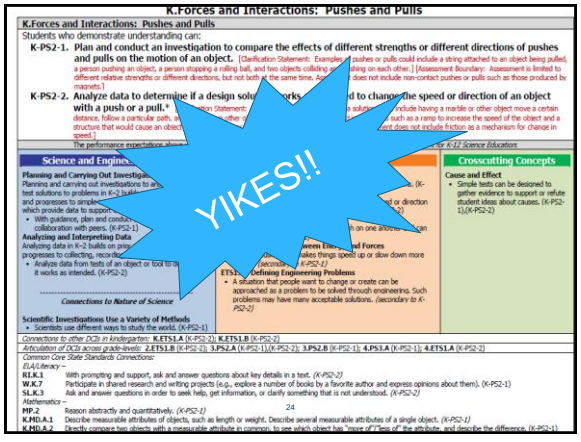
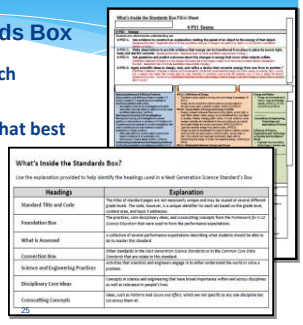


## What's Inside the Standards Box?

### Exploring the Standards Box

- Read the explanation for each heading
- Write a heading in the box that best explains each section of the Standards Box.



What's Inside the Standards Box?

Use the explanation provided to help identify the headings used in a Next Generation Science Standard's Box

| Headings | Explanation |
|---|---|
| Standard Title and Code | The titles of standard pages are not necessarily unique and may be reused at several different grade levels. The code, however, is a unique identifier for each set based on the grade level, content area, and topic it addresses. |
| Foundation Box | The practices, core disciplinary ideas, and crosscutting concepts from the Framework K-12 Science Education that were used to form the performance expectations. |
| What is Assessed | A collection of science performance expectations describing what students should be able to do to master this standard. |
| Connection Box | Other standards in the next Generation Science Standards or in the Common Core State Standard that are relate to this standard. |
| Science and Engineering Practices | Activities that scientists and engineers engage in to either understand the world or solve a problem. |
| Disciplinary Core Ideas | Concepts in science and engineering that have broad importance within and across disciplines as well as relevance to people's lives. |
| Crosscutting Concepts | Ideas, such as Patterns and Cause and Effect, which are not specific to any one discipline but cut across them all. |

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## Title and Performance Expectations

**4-PS3 Energy**

**Title and Code**
The titles of standard pages are not necessarily unique and may be reused at several different grade levels . The code, however, is a unique identifier for each set based on the grade level, content area, and topic it addresses.

**What is Assessed**
A set of performance expectations describing what students should know and be able to do to master this standard

| 4-PS3 Energy | |
|---|---|
| Students who demonstrate understanding can: | |
| 4-PS3-1. | **Use evidence to construct an explanation relating the speed of an object to the energy of that object.** [Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or any precise or quantitative definition of energy.] |
| 4-PS3-2. | **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [Assessment Boundary: Assessment does not include quantitative measurements of energy.] |
| 4-PS3-3. | **Ask questions and predict outcomes about the changes in energy that occur when objects collide.** [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.] |
| 4-PS3-4. | **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.*** [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.] |

## A Closer Look at a Performance Expectation

**K-LS1 From Molecules to Organisms: Structures and Processes**

| K-LS1 From Molecules to Organisms: Structures and Processes |
|---|
| Students who demonstrate understanding can: |

**K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|
| **Analyzing and Interpreting Data**<br>Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.<br>• Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) | **LS1.C: Organization for Matter and Energy Flow in Organisms**<br>• All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K-LS1-1) | **Patterns**<br>• Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) |
| *Connections to Nature of Science*<br>**Scientific Knowledge is Based on Empirical Evidence**<br>• Scientists look for patterns and order when making observations about the world. (K-LS1-1) | | |

**Note:** Performance expectations combine practices, core ideas, and crosscutting concepts into a single statement of ***what is to be assessed.***

They are not instructional strategies or objectives for a lesson.

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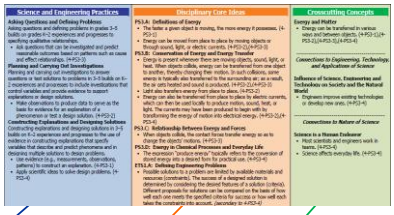
## Foundation Box

**Foundation Box**
The practices, core disciplinary ideas, and crosscutting concepts from the *Framework for K-12 Science Education* that were used to form the performance expectations



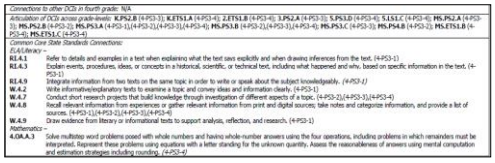

**Scientific & Engineering Practices**
Activities that scientists and engineers engage in to either understand the world or solve a problem

**Disciplinary Core Ideas**
Concepts in science and engineering that have broad importance within and across disciplines as well as relevance in people's lives.

**Crosscutting Concepts**
Ideas, such as *Patterns* and *Cause and Effect*, which are not specific to any one discipline but c[illegible] them all.

## The Connection Box

**Connection Box**
Other standards in the *Next Generation Science Standards* or in the *Common Core State Standards* that are related to this standard



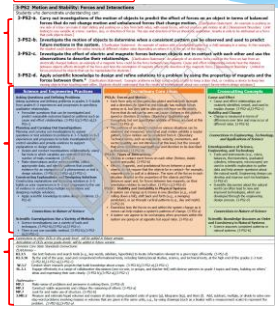

## Inside the NGSS Box

**Title and Code**
The titles of standard pages are not necessarily unique and may be reused at several different grade levels . The code, however, is a unique identifier for each set based on the grade level, content area, and topic it addresses.

**What is Assessed**
A collection of several performance expectations describing what students should be able to do to master this standard

**Foundation Box**
The practices, core disciplinary ideas, and crosscutting concepts from the *Framework for K-12 Science Education* that were used to form the performance expectations

**Connection Box**
Other standards in the *Next Generation Science Standards* or in the *Common Core State Standards* that are related to this standard



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# How is content articulated in the NGSS?

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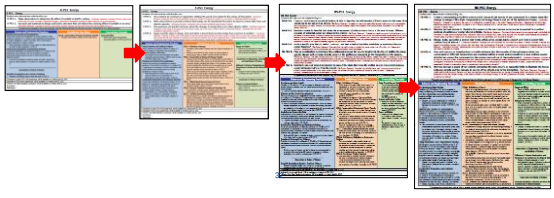
## Review and discuss the progression of energy standards with a partner or your team.

Kindergarten | Grade 4 | Middle School | High School



## Partner/Group Review and Discussion

NEXT GENERATION SCIENCE STANDARDS

Questions to explore with a partner or team
- How do the standards for Energy build coherently K-HS?
- How does the cognitive rigor progress K-HS?
- What are the opportunities for integration with CCSS and STEM?

| Core Idea: Energy | | | |
|---|---|---|---|
| Coherence<br>*How do the Core Ideas progress K-12* | Cognitive Rigor | Integration with CCSS<br>Math and Literacy | Integration with STEM |
| Evidence: | Evidence: | Evidence: | Evidence: |
| What are the implications of NGSS for planning and teaching in your school? | | | |

Discuss and Record your observations:

- How do the standards build coherently K-HS?
- How do core ideas progress K-12.
- How does the cognitive rigor progress K-HS?
- What are the opportunities for integration with ELA, Math, and STEM?

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## What are the three dimensions of learning in the NGSS?

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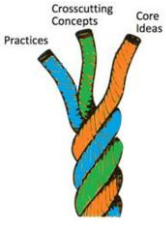
## Three Dimensions Intertwined




- The NGSS are written as Performance Expectations
- NGSS will require contextual application of the three dimensions by students.

http://www.nextgenscience.org/msps1-matter-interactions

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## Dimension 1
## Science and Engineering Practices

- Behaviors that scientists engage in as they investigate, build models, analyze data and communicate information
- "Practices" rather than "skills" since knowledge and skills are required that are specific to each practice.
- Engineering involves solving a problem through design.
- Engineering practices make STEM relevant to students.

*Framework*, pp. 41-82

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## Asking Questions. . .

**Why are there seasons?**

**Why did the structure collapse?**

**How is electric power generated?**

**What do plants need to survive?**

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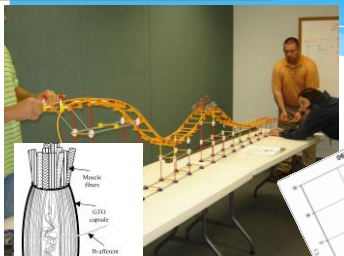
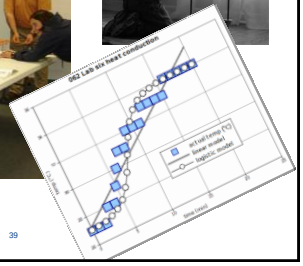
## . . . Defining Problems


## Developing and Using Models



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## Planning and Carrying Out Investigations

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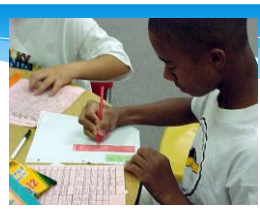
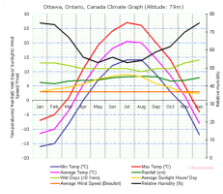
## Analyzing and Interpreting Data



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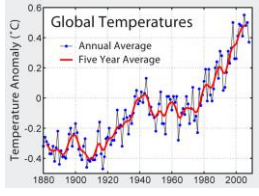
## Using Mathematics and Computational Thinking

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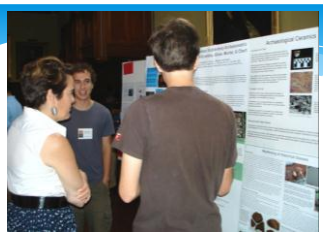

Constructing Explanations (Science) and . . .

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. . . Designing Solutions (Engineering)

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Engaging in Argument from Evidence

Obtaining, Evaluating, and Communicating Information

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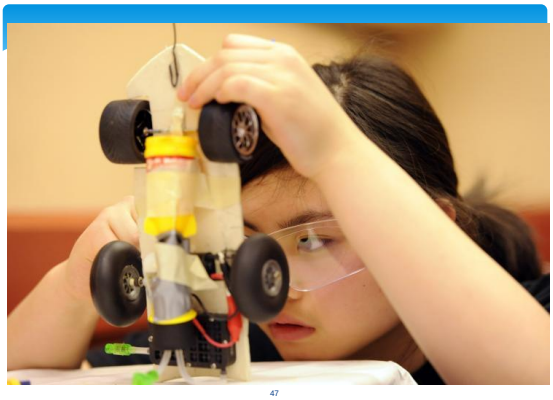

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## Dimension 2
## Crosscutting Concepts

- Have application across all domains of science
- Provide an organizational schema for interrelating knowledge from various science fields
- Include:
  (1) Patterns, similarity, and diversity;
  (2) Cause and effect;
  (3) Scale, proportion and quantity;
  (4) Systems and system models;
  (5) Energy and matter;
  (6) Structure and function;
  (7) Stability and change

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# Dimension 3
# Disciplinary Core Ideas

* Focus K–12 science curriculum, instruction and assessments on the most important aspects of science
  * Broad importance or key organizing principle
  * Key tool for understanding complex ideas
  * Connected to personal or societal concerns
  * Teachable and learnable at multiple grades

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# Disciplinary Core Ideas

**Physical Science**

PS1: Matter & Interactions

PS2: Motion & Stability: Forces and Interactions

PS3: Energy

PS4: Waves and Their Applications in Technologies for Information Transfer

**Life Science**

LS1: From Molecules to Organisms

LS2: Ecosystems: Interaction, Energy & Dynamics

LS3: Heredity: Inheritance and Variation of Traits

LS4: Biological Evolution: Unity & Diversity

**Earth & Space Science**

ESS1: Earth's Place in the Universe

ESS2: Earth's Systems

ESS3: Earth & Human Activity

**Engineering Design**

ETS1: Engineering Design

Influence of Science, Engineering, and Technology on Society and the Natural World

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# Current State Science Standard Sample

**Inquiry Standards**

Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.

Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

**Content Standards**

Distinguish between atoms and molecules.

Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.

Identify and demonstrate the Law of Conservation of Matter.

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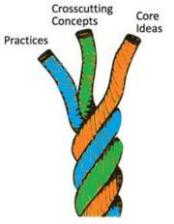
## Three Dimensions Intertwined




- The NGSS are written as Performance Expectations
- NGSS will require contextual application of the three dimensions by students.

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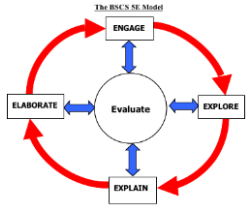
## The 5E Instructional Model

- **Appropriate for lessons or units**
- **Activates prior knowledge**
- **Student-centered**
- **Multiple opportunities to explore**
- **Connects to real world scenarios**
- **Assessment opportunities in each E**

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## Middle School

- **Engage:** describe characteristics of two fossil brachiopods to see if changes occurred; supply evidence to support claim
- **Explore:** measure and graph characteristics of two populations; propose explanations for variations
- **Explain:** present explanations and evidence
- **Elaborate:** Students review images of embryological development for similarities; research the similarities of related organisms and how they evolved
- **Evaluate:** students answer questions about variation in a population of cheetahs and describe how variation results in some individuals surviving and reproducing

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## Performance Expectation?

| 5E | Practices | DCIs | Crosscutting |
|---|---|---|---|
| Engage | | | |
| Explore | | | |
| Explain | | | |
| Elaborate | | | |
| Evaluate | | | |

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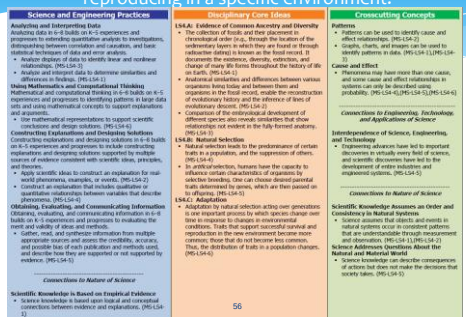
## MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individual's probability of surviving and reproducing in a specific environment.



**Science and Engineering Practices**

**Analyzing and Interpreting Data**
Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)
- Apply concepts of statistics to determine similarities and differences in findings. (MS-LS4-1)

**Using Mathematics and Computational Thinking**
Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

**Constructing Explanations and Designing Solutions**
Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

**Obtaining, Evaluating, and Communicating Information**
Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

*Connections to Nature of Science*

**Scientific Knowledge is Based on Empirical Evidence**
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)

**Disciplinary Core Ideas**

**LS4.A: Evidence of Common Ancestry and Diversity**
- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

**LS4.B: Natural Selection**
- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)
- In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

**LS4.C: Adaptation**
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)

**Crosscutting Concepts**

**Patterns**
- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4-3)

**Cause and Effect**
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-6),(MS-LS4-5),(MS-LS4-6)

*Connections to Engineering, Technology, and Applications of Science*

**Interdependence of Science, Engineering, and Technology**
- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

*Connections to Nature of Science*

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

**Science Addresses Questions About the Natural and Material World**
- Science knowledge can describe consequences of actions but does not make the decisions that society takes. (MS-LS4-5)

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## Elementary School

- Engage: Students are given an example of a plant or animal and tell where it lives.
- Explore: teams of two students visit the school yard to answer: "How many different plants and animals can you observe?"
- Explain: student present their findings from the trip
- Elaborate: students are asked to collect pictures of three different organisms, display the pictures and describe their habitats
- Evaluate: Students are given pictures of plants and animals in different habitats; describe the plants and animals and describe how their actions are like scientists.

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## High School

- **Engage**: view images of the "arms" of organisms, and attempt to identify their habitat; discuss adaptations.
- **Explore**: review slides of the Galapagos Islands and examine data on beak depth and tarsal length in finches. How could variation in beak depth help or harm finches?
- **Explain:** read and discuss Darwin's description of natural selection.
- **Elaborate:** examine morphological features of apes and humans. Students build models to compare DNA codes for proteins to determine relatedness of organisms.
- **Explain:** describe findings and predict relationships to ancestor
- **Evaluate:** use graphical evidence for natural selection to construct an explanation for adaptation of populations

Included here for reference to illustrate the 5E model in high school

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## What shifts are necessary for teaching and learning in the NGSS?

NEXT GENERATION SCIENCE STANDARDS
For States, By States

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## Conceptual Shifts in the NGSS

1. K-12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world.
2. The Next Generation Science Standards are student performance expectations – **NOT** curriculum.
3. The science concepts build coherently from K-12.
4. The NGSS focus on deeper understanding of content as well as application of content.
5. Science and Engineering are integrated in the NGSS from K–12.
6. NGSS content is focused on preparing students for the next generation workforce.
7. The NGSS and Common Core State Standards (English Language Arts and Mathematics) are **Aligned.**

NEXT GENERATION SCIENCE STANDARDS For States, By States

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# Maryland and the NGSS: Where are We Going?

Maryland State Department of Education
Preparing World-Class Students

NEXT GENERATION SCIENCE STANDARDS
For States, By States

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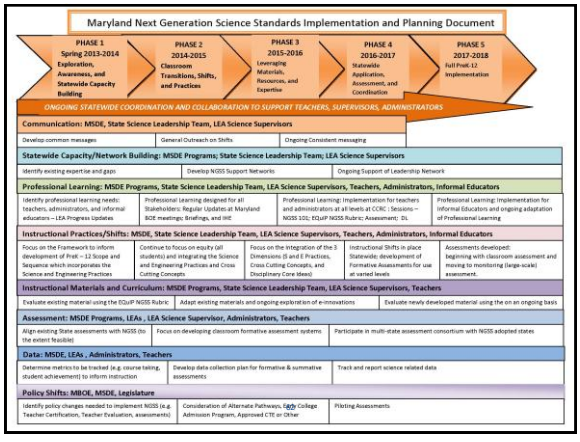

Maryland Next Generation Science Standards Implementation and Planning Document

| PHASE 1 Spring 2013-2014 Exploration, Awareness, and Statewide Capacity Building | PHASE 2 2014-2015 Classroom Transitions, Shifts, and Practices | PHASE 3 2015-2016 Leveraging Materials, Resources, and Expertise | PHASE 4 2016-2017 Statewide Application, Assessment, and Coordination | PHASE 5 2017-2018 Full PreK-12 Implementation |
|---|---|---|---|---|
| ONGOING STATEWIDE COORDINATION AND COLLABORATION TO SUPPORT TEACHERS, SUPERVISORS, ADMINISTRATORS | | | | |
| **Communication: MSDE, State Science Leadership Team, LEA Science Supervisors** | | | | |
| Develop common messages | General Outreach on Shifts | Ongoing Consistent messaging | | |
| **Statewide Capacity/Network Building: MSDE Programs; State Science Leadership Team; LEA Science Supervisors** | | | | |
| Identify existing expertise and gaps | Develop NGSS Support Networks | Ongoing Support of Leadership Network | | |
| **Professional Learning: MSDE Programs, State Science Leadership Team, LEA Science Supervisors, Teachers, Administrators, Informal Educators** | | | | |
| Identify professional learning needs: teachers, administrators, and informal educators – LEA Progress Updates | Professional Learning designed for all Stakeholders: Regular Updates at Maryland BOE meetings: Briefings, and IHE | Professional Learning: Implementation for teachers and administrators at all levels at CCRC : Sessions – NGSS 101; EQuIP NGSS Rubric Assessment: DL | Professional Learning: Implementation for Informal Educators and ongoing adaptation of Professional Learning | |
| **Instructional Practices/Shifts: MSDE, State Science Leadership Team, LEA Science Supervisors, Teachers, Administrators, Informal Educators** | | | | |
| Focus on the Framework to inform development of PreK – 12 Scope and Sequence which incorporates the Science and Engineering Practices | Continue to focus on equity (all students) and integrating the Science and Engineering Practices and Cross Cutting Concepts | Focus on the integration of the 3 Dimensions (5 and E Practices, Cross Cutting Concepts, and Disciplinary Core Ideas) | Instructional Shifts in place Statewide; development of Formative Assessments for use at varied levels | Assessments developed: beginning with classroom assessment and moving to monitoring (large-scale) assessment. |
| **Instructional Materials and Curriculum: MSDE Programs, State Science Leadership Team, LEA Science Supervisors, Teachers** | | | | |
| Evaluate existing material using the EQuIP NGSS Rubric | Adapt existing materials and ongoing exploration of e-innovations | Evaluate newly developed material using the on an ongoing basis | | |
| **Assessment: MSDE Programs, LEAs , LEA Science Supervisor, Administrators, Teachers** | | | | |
| Align existing State assessments with NGSS (to the extent feasible) | Focus on developing classroom formative assessment systems | Participate in multi-state assessment consortium with NGSS-adopted states | | |
| **Data: MSDE, LEAs , Administrators, Teachers** | | | | |
| Determine metrics to be tracked (e.g. course taking, student achievement) to inform instruction | Develop data collection plan for formative & summative assessments | Track and report science related data | | |
| **Policy Shifts: MBOE, MSDE, Legislature** | | | | |
| Identify policy changes needed to implement NGSS (e.g. Teacher Certification, Teacher Evaluation, assessments) | Consideration of Alternate Pathways, Early College Admission Program, Approved CTE or Other | Piloting Assessments | | |

# Phase I: Spring 2013-2014

- Exploration
- Awareness
- State capacity-building
  - Teachers
  - LEA Science Supervisors
  - State Science Leadership Team
  - MSDE staff

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## Phase 2: 2014-2015

Classroom transitions, K-12
- Map scope and sequence
- Incorporate Engineering Practices

Shifts in instruction
- Integrate the three Dimensions
- Focus on teaching through the Science and Engineering Practices
- Incorporate formative assessment tasks
- Continue to evaluate instructional resources using the EQuIP rubric

Identify possible policy changes to implement NGSS

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## Phase 3: 2015-2016

Classroom transitions, K-12
- Refine scope and sequence
- Articulate Performance Expectations among grades and courses
- Refine formative assessment tasks
- Continue to evaluate, incorporate and refine instructional resources using the EQuIP rubric

Provide professional learning opportunities for teachers and administrators

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## Phase 4: 2016-2017

Ongoing support of leadership network
- Professional learning
- Assessment development
  - Multistate consortium with NGSS states
  - State-level assessment system
- Data collection: courses, student achievement

Policy changes
- Course credit requirements
- Teacher evaluation

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## Phase 5: 2017-2018

Full PreK-12 implementation

- Scope and sequence appropriate for all LEAs
- High school credit requirements in place
- Assessment system in place
- Instructional resources and strategies aligned with NGSS
- Professional learning for pre-service and new teachers
- Data reporting, storage and retrieval system in place

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## Outcomes

- Explained the reasons for building new science standards.
- Described the process and timeline for constructing the Framework and the NGSS.
- Described the structure of a standard within NGSS.
- Discussed the implications of the "shifts" in NGSS for teaching and learning.
- Examined instructional strategies that reflect the intent of NGSS.

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## Resources

**A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2012)**

http://www.nap.edu/catalog.php?record_id=13165#

**Developing Assessments for the Next Generation Science Standards**

http://www.nap.edu/download.php?record_id=18409

**NSTA**

http://ngss.nsta.org/access-standards/

## Exit Slip

* Write a message that describe the implications of the NGSS for teaching and learning in YOUR classroom.
  * Tweet
  * Message
  * Facebook


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## Science Contacts

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**Next Generation Science Standards**
www.nextgenscience.org

**National Academy of Sciences**
http://sites.nationalacademies.org/dbasse/bose/framework_k12_science/index.htm

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